

What is claimed is:

1. A coil component, comprising:

a coil section having a through hole, the coil section comprising a plurality of ring sections formed of a metallic flat plate disposed in a plane and connected to each other at ring connecting sections, the ring sections being bent at the ring connecting sections and placed one on top of another to form the coil section;

terminals connected to the coil section; and

a package member covering the coil section and having the terminals projecting therefrom,

wherein each of the ring sections comprises an arc-shaped portion having a slit formed by cutting a part of the ring section, the ring connecting sections are formed at end sections of the arc-shaped portions of the ring sections where the ring sections are connected to each other, and the terminals are formed at end sections of the arc-shaped portions of the ring sections where the ring sections are not connected to each other.

2. The coil component according to claim 1, wherein in the plurality of ring sections formed of a metallic flat plate disposed in a plane, a sum of an angle formed by center lines each connecting centers of the ring sections connected by the ring connecting section and adjacent to each other and angles each formed by the center line of the ring section connected to the terminal and an extension line extending from the center of the ring section toward the end section formed with the terminal is approximately 180° .

3. The coil component according to claim 1, wherein each terminal is provided on an extension line extending from a center of the ring section toward the end section formed with the terminal.

4. The coil component according to claim 1, wherein each of the ring connecting sections has a groove formed therein for

bending.

5. The coil component according to claim 3, wherein the groove is formed in a direction perpendicular to a center line connecting centers of the ring sections adjacent to each other and connected by the ring connecting section.

6. The coil component according to claim 1, wherein a projection extending toward the slit is formed at each end section of the arc-shaped portion of the ring section where the ring sections are connected to each other.

7. The coil component according to claim 1, wherein the ring sections have substantially equal outside diameters.

8. The coil component according to claim 1, wherein peripheral edge portions of the ring sections are chamfered.

9. The coil component according to claim 1, wherein each terminal provided at the end section of the arc-shaped portion of the ring section where the ring sections are not connected to each other has a step, and the step formed on one terminal and the step formed on the other terminal are arranged to be in such directions that the terminals approach each other when the ring sections are placed one on top of another in a same phase.

10. The coil component according to claim 1, wherein the ring section excluding the ring connecting section is provided with an insulating coating layer.

11. The coil component according to claim 1, wherein the plurality of ring sections are four ring sections, the four ring sections being disposed in half respectively at upper and lower positions in parallel to each other, a center line connecting centers of the upper and lower ring sections and a center line connecting centers of the left and right ring sections intersect each other at an angle of about 60° , and the upper and lower four ring sections are connected by the connecting sections.

12. The coil component according to claim 1 or 11, wherein a length of the ring connecting section formed at one end section

of the arc-shaped portion of the ring section is greater than a length of the ring connecting section formed at the other end section.

13. The coil component according to claim 1, wherein the package member has an outside shape of a prism, each ring connecting section is disposed in a corner portion of the package member, and each of the terminals is disposed between the corner portions of the package member.

14. The coil component according to claim 1, wherein the plurality of ring sections formed of a metallic flat plate disposed in a plane are formed by etching or die-cutting.

15. The coil component according to claim 1, wherein the package member is formed by: mixing a binder including thermosetting resin and magnetic powder in a non-heated state so that the thermosetting resin does not set completely; providing a compacted powder body with low hardness portions having such a hardness that the compacted powder body loses its shape; pressure-forming the compacted powder body in the non-heated state; re-pressure forming the compacted powder body so that the low hardness portions of the compacted powder body cover the coil section; and heating the re-pressure formed thermosetting resin to be completely set.

16. The coil component according to claim 15, wherein the compacted powder body is provided with a high hardness portion having such a hardness that the compacted powder body does not lose its shape in the re-pressure forming and the low hardness portion having such a hardness that the compacted powder body loses its shape in the re-pressure forming, and the high hardness portion of at least one compacted powder body in the package member supports one face of the coil section.

17. The coil component according to claim 1, wherein the package member is a magnetic core including magnetic powder and has an upper face portion corresponding to an upper portion of

the coil section, a lower face portion corresponding to a lower portion of the coil section, and an intermediate portion corresponding to a height portion of the coil section, wherein a thickness of a skin encapsulating the coil section is smaller than a diameter of the through hole of the coil section, and a density of the upper face portion and a density of the lower face portion are higher than a density of the intermediate portion.

18. A method of producing a coil component, comprising the steps of forming a coil section having a through hole, and forming a package member by covering the coil section with a package member and causing terminals connected to the coil section to project from the package member, wherein

in the step of forming the coil section, a plurality of ring sections formed of a metallic flat plate disposed in a plane and connected to each other by ring connecting sections are formed, and the ring sections are bent at the ring connecting sections and placed one on top of another, and

each ring section is formed of an arc-shaped portion having a slit formed by cutting a part of the ring section, each ring connecting section is formed at an end section of the arc-shaped portion of the ring section where the ring sections are connected to each other, and each terminal is formed at an end section of the arc-shaped portion of the ring section where the ring sections are not connected to each other.

19. The method of producing the coil component according to claim 18, wherein in the plurality of the ring sections formed of a metallic flat plate disposed in a plane, a sum of an angle formed by center lines each connecting centers of the ring sections adjacent to each other and connected by the ring connecting section, and angles each formed by the center line of the ring section connected to the terminal and an extension line extending from the center of the ring section toward the end section formed with the terminal is approximately 180°.

20. The method of producing a coil component according to claim 18, wherein each terminal is provided on an extension line extending from a center of the ring section toward the end section formed with the terminal.

21. The method of producing a coil component according to claim 18, wherein each ring connecting section is formed with a groove for bending.

22. The method of producing a coil component according to claim 21, wherein each groove is formed in a direction perpendicular to a center line connecting centers of the ring sections adjacent to each other and connected by the ring connecting section.

23. The method of producing a coil component according to claim 18, wherein a projection extending toward the slit is formed at each end section of the arc-shaped portion of the ring section where the ring sections are connected to each other.

24. The method of producing a coil component according to claim 18, wherein the ring sections have substantially equal outside diameters.

25. The method of producing a coil component according to claim 18, wherein peripheral edge portions of the ring sections are chamfered.

26. The method of producing a coil component according to claim 18, wherein a step is formed on each terminal provided at the end section of the arc-shaped portion of the ring section where the ring sections are not connected to each other, and the steps formed on one terminal and the other terminal are arranged to be in such directions that the terminals approach each other when the ring sections are placed one on top of another in a same phase.

27. The method of producing a coil component according to claim 18, wherein each ring section, excluding the ring connecting section, is provided with an insulating coating layer.

28. The method of producing a coil component according to

claim 18, wherein a length of the ring connecting section formed at one end section of the arc-shaped portion of the ring section is greater than a length of the ring connecting section formed at the other end section.

29. The method of producing a coil component according to claim 18, wherein the package member has an outside shape of a prism, each ring connecting section is disposed at a corner portion of the package member, and each terminal is disposed between the corner portions of the package member.

30. The method of producing a coil component according to claim 18, wherein the plurality of ring sections formed of a metallic flat plate disposed in a plane are formed by etching or die-cutting.

31. The method of producing a coil component according to claim 18, wherein the package member forming step comprises:

mixing a binder including thermosetting resin and magnetic powder in a non-heated state so that the thermosetting resin does not set completely, and pressure forming the mixed binder to provide two compacted powder bodies; and

forming each compacted powder body to include a low hardness portion having such a hardness that the compacted powder body loses its shape, re-pressure forming each compacted powder body to cover the coil sections, and heating the re-pressure formed compacted powder body so that the thermosetting resin is completely set, thereby to form the package member.

32. The method of producing a coil component according to claim 18, wherein in the re-pressure forming, each compacted powder body is formed to include a high hardness portion having such a hardness that the compacted powder body does not lose its shape and a low hardness portion having such a hardness that the compacted powder body loses its shape, and in forming the package member, the high hardness portion of the compacted powder body supports one face of the coil.

33. The method of producing a coil component according to claim 18, wherein the package member forming step comprises setting a thickness of a skin encapsulating the coil section to be smaller than a diameter of the through hole of the coil section, and setting a density of an upper face portion of the package member corresponding to an upper portion of the coil section and a density of a lower face portion of the package member corresponding to a lower portion of the coil section at higher values than that of a density of an intermediate portion of the package member corresponding to a height portion of the coil section.